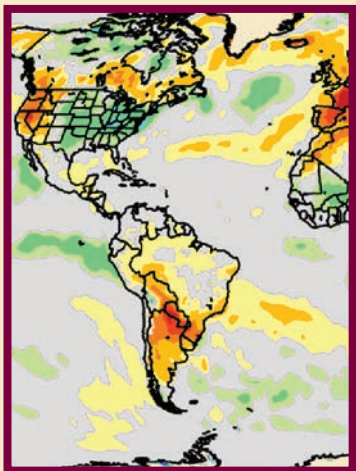




Annual Report 2003



NOAA's National Climatic Data Center

Protecting the Past,
Revealing the Future

A large, modern building with many windows, likely the NOAA National Climatic Data Center, set against a sunset background with trees and a lightning bolt. The building is white with blue-tinted windows. The sky is a mix of orange, red, and blue. There are silhouettes of trees in the foreground and a bright lightning bolt in the upper right corner.



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The year 2003 was highlighted by a variety of accomplishments indicative of the diverse nature of the National Climatic Data Center (NCDC) and the commitment of our employees to serving the public. Examples of this very active year include:

- Monumental strides developing the Remote Sensing and Applications Division and initiating a much needed program in Scientific Data Stewardship (page 3);
- Increase in climate data access (page 4);
- Improved data quality control (QC) (page 5);
- Continued efforts related to the Comprehensive Large Array-data Stewardship System (CLASS) (page 5);
- Continued progress to image and digitize a wide variety of historical climatological data through the Climate Database Modernization Program (CDMP) (page 6);
- At the end of 2003, 37 U.S. Climate Reference Network stations were ready to be commissioned (page 7);
- Improved climate monitoring capabilities and completion of State-of-the-Climate Reports (page 8);
- Development of NOAA Operational Model Archive and Distribution System (NOMADS) (page 11);
- New data products and reference data sets added to archive (page 12);
- NOAA's Paleoclimate Program continues to be highly productive (page 15);
- Continued support to our local community (page 16);
- Web site reorganized (page 24).

These accomplishments contributed to an important year for NCDC - a year for which all NCDC employees and partners can be proud. We met, and in many cases exceeded, our milestones to provide better products and services to our many and broad-based customers and to ensure that in future years we continue to play a prominent role in homeland security, public safety, protection of property, sustainable development, and environmental awareness. Building on past success and looking to the future, we see NCDC as the world's most comprehensive source and recognized authority for weather and climate information, official assessments of the climate in support of societal and economic needs, as well as a leader in observing the climate. To attain this stature, we continue to build successful partnerships with the private sector, academia, and other government agencies.

In 2003, the focus was on improving weather and climate services and continuing to provide near real-time data to climatological customers. We reported regularly on the state of the Nation's climate, and issued important announcements on the climate trends of the atmosphere. Our ever-improving on-line capabilities continued to satisfy a record number of Internet users with an expansive amount of archived data that can be easily accessed and downloaded. The contributions of NOAA's six Regional Climate Centers (RCC) and our partners in the American Association of State Climatologists (AASC) have been critical to these efforts.

Beyond our traditional weather and climate services, our environmental data and information continue to be used to support national and global disaster mitigation and relief efforts. NCDC is a critical and integral part of the NOAA team, and plays a major role in NOAA's Climate Services Program. We expect more involvement during 2004 and continued interaction across NOAA and within its National Environmental Satellite, Data, and Information Service (NESDIS).

Without the extraordinary efforts of the Center's highly dedicated and talented personnel, all that is described in this report would not have been possible. I extend my sincere appreciation and gratitude for the efforts put forth by NCDC's personnel and partners. I hope you find this report informative and helpful in understanding the very special role the NCDC plays in serving our broad-based constituency with the highest quality products and services. We look forward to continuing to provide new and even better climate information services to the people of our Nation and the world.



Thomas R. Karl
Director

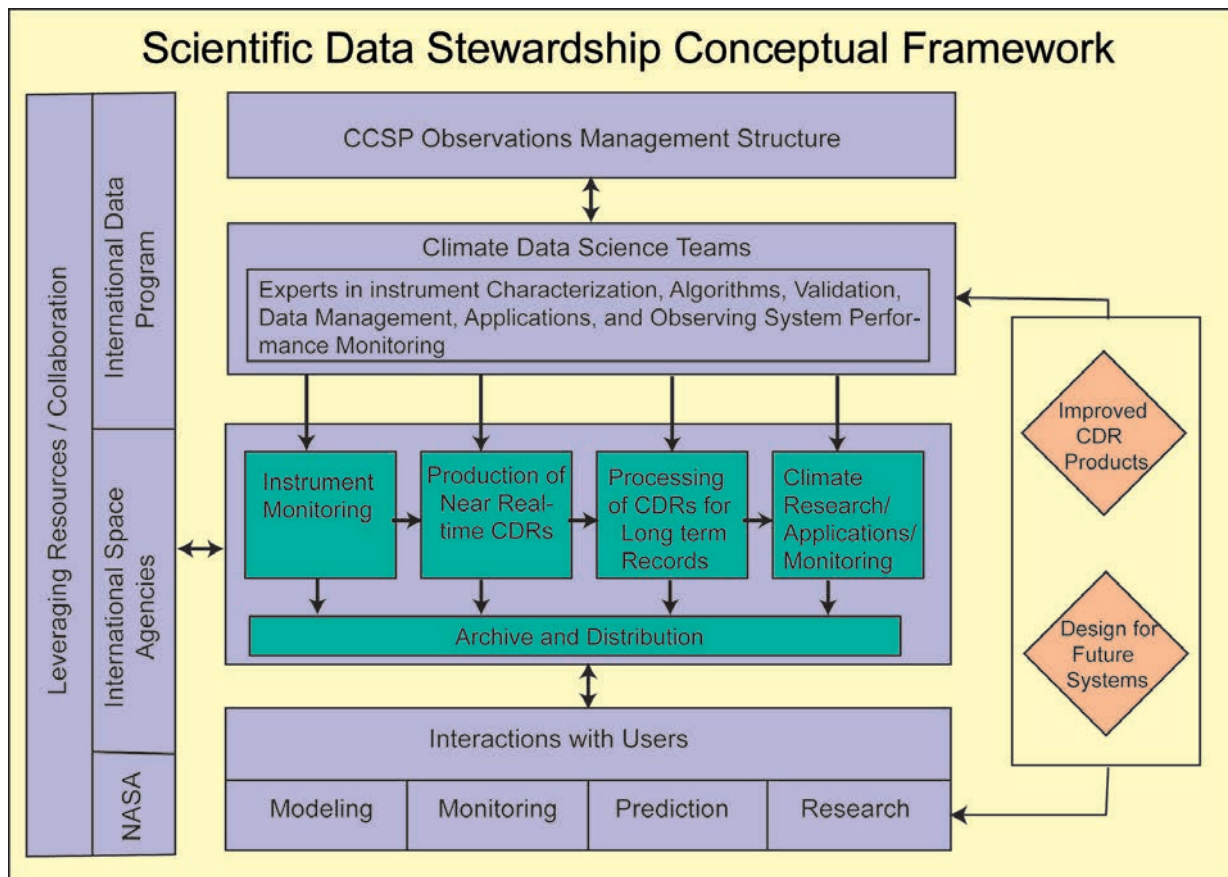
Remote Sensing and Applications Division (RSAD)

Division Activities

The RSAD embarked on an ambitious program to enhance NOAA's ability to provide improved products and services to climate users and other customers interested in gleaned information from NOAA's vast holdings of satellite and radar data. In 2003, the Satellite Services Branch redirected its focus to Scientific Data Stewardship (SDS) and moved from Suitland, Maryland, to Asheville, North Carolina. To improve customer service, RSAD enhanced capabilities of the Comprehensive Large Array-data Stewardship System (CLASS) by providing updated user requirements. RSAD added scientific expertise with three new hires.

Joint efforts within NESDIS provided the conceptual framework for SDS, which has five objectives:

- 1) Develop real-time monitoring of all satellite observing systems;
- 2) Generate climate data records (CDRs) in near real-time;
- 3) Process large volumes of satellite data extending up to decades in length to account for systematic errors and to eliminate artifacts;
- 4) Conduct research by analyzing data sets to uncover climate trends;
- 5) Provide archives of both raw data records and CDRs and facilitate distribution of CDRs to the community.



Each phase of this end-to-end system requires collaboration with climate data science teams, input from climate data users, and should leverage knowledge and resources from other climate data programs and organizations.

Customer Satisfaction Measures

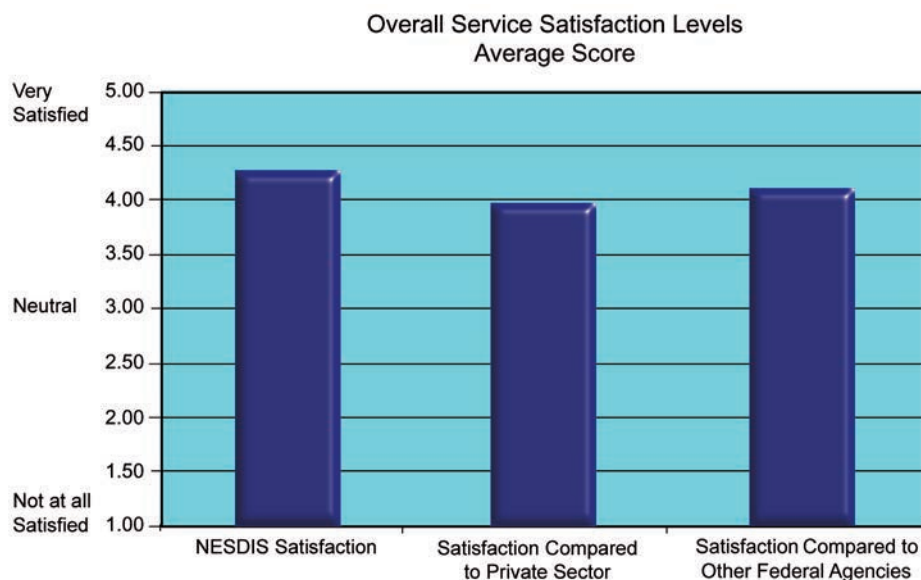
NCDC continued to expand in the area of E-Government. In 2003, more than 70% of orders traditionally received by telephone or mail were automatically serviced on-line. To make certain that our customers are happy with these on-line services as well as our traditional service, NCDC led two efforts to measure customer satisfaction.

First, NCDC took the lead in NESDIS by implementing a NESDIS customer satisfaction survey. The survey of users who requested data from the three NESDIS Data Centers and the Office of Satellite Data Processing and Distribution asked users to rate their satisfaction on issues such as quality of product and service received, accessibility of data, and timeliness of response. Users identified the type of data received, and primary use of the product, as well as the benefit of the data to the user or user's company. Based on more than 6,000 customers who responded, users are satisfied or extremely satisfied with the product and/or service received.

Second, NCDC led the planning of the June 2003 NESDIS Data Users Workshop for constituents in Boulder, Colorado. The workshop, attended by 375 participants, helped:

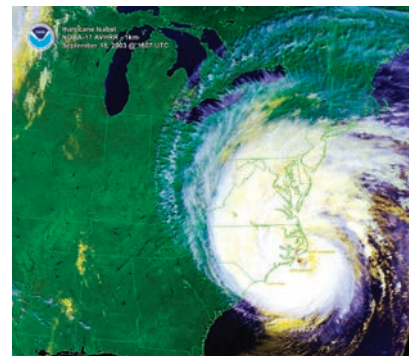
- improve communication and rapport with users;
- assess users' needs and societal benefits;
- solicit users' opinions on current NESDIS data and information products and services;
- inform users of future capabilities, plans, and data sets; and
- review and update user needs for new products, data archiving, access, and future plans.

NOAA Administrator Vice Admiral Conrad C. Lautenbacher delivered the keynote address supplying a summary of NOAA plans, and Gregory W. Withee, NOAA Assistant Administrator for NESDIS, summarized NESDIS plans. Each of the four primary data center plans were then presented by the respective center directors. Six constituent breakout groups provided 188 recommendations from the participants. NESDIS is currently developing a plan of action for these recommendations. A report with workshop photographs and presentations is located at: <http://www.osd.noaa.gov/datausers/index.htm>.



Geostationary Operational Environmental Satellite (GOES) Data Incorporated in CLASS

NCDC has two new capabilities within CLASS: GOES data is now on-line, and there is a dual site. CLASS archives large array-data sets (e.g., satellite data) and provides the data on-line through the CLASS web site, physically located in Suitland, Maryland. The dual site capability will be launched at Asheville, North Carolina, in the spring of 2004. The two sites will have identical capabilities for ingesting, archiving and disseminating data. Defined primary functions can be done at either site as needed and each site will archive the same data sets, thus providing backup for the other location. GOES, Polar Operational Environmental Satellite, and Defense Meteorological Satellite Program data sets and products are now archived and disseminated through CLASS.

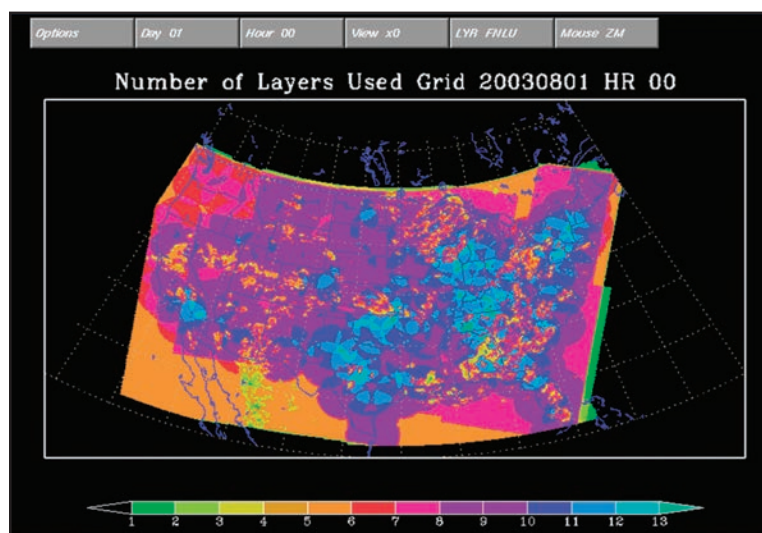


CLASS began ingesting and archiving GOES data on December 1, 2003. Users can request GOES data archived since that time by accessing the CLASS web site at <http://www.class.noaa.gov> and selecting the product *GOES Variable Data Format*. CLASS offers the capability to view, browse images, and search by region of interest. In 2004, the entire period of record for GOES data will be available on-line.

Improved Data Quality Control (QC) Continues

NCDC continued to improve its data QC in 2003. Enhancements were made to the automated operational temperature validation quality assurance system for the *Cooperative Summary of the Day* data. The system uses rules-based Geographical Information System (GIS) technology to automate spatial quality assurance of observed daily temperature values. NCDC also launched a Precipitation Validation (PrecipVal) QC process for the in-situ data network. This new spatial precipitation estimator system uses rules-based GIS technology and multiple external data sources to estimate precipitation totals for any point in the continental United States. The estimated values provide an independent assessment for the quality assurance of daily and hourly in-situ precipitation data. External data sources include the National Weather Service's (NWS) Automated Surface Observation System (ASOS) Network, Climate Reference Network (CRN), National

Center for Environmental Prediction (NCEP) Rapid Update Cycle model, GOES, and Weather Surveillance Radar 1988 Doppler (WSR-88D). A precipitation estimator module replaces the current interactive graphical validation processes that often require manual review of suspect data, limiting the amount of data that receives spatial inter-comparison. Confidence in PrecipVal is attributed to a change in methodology (using multiple external layers) and access to higher quality "ground truth" data. Additionally, PrecipVal is able to estimate hourly or daily precipitation values for all missing days, whereas the previous validation process only estimated precipitation values under certain conditions. Evaluation of the new system using statistical analysis and manual verification is ongoing.



Climate Database Modernization Program

Program Goals

The goal of CDMP is to make major climate databases available via the Internet. NCDC has managed the CDMP for four years. The program continued to grow and expand in 2003, and now includes tasks involving five NOAA line offices, RCCs, the AASC, Foreign Meteorological Services, the U.S. Air Force and the World Meteorological Organization (WMO). As a result of this program, the number of images available on-line has now exceeded 40 million records with more than five terabytes of data.

Modernization continued to involve the keying of observations; the imaging of original records on paper, microform, or photographs; the vectorizing of shorelines; and the digitizing of analog recordings. The program continued its support of international data rescue, with data modernization efforts underway in Africa and Central America. CDMP arranged agreements to image or key marine databases with Canada, Germany, China and the WMO Library.

NCDC has a new on-line system to provide transparent public access to recent and historical serial publications for both paying customers (through the NCDC on-line store) and free access users. The first publication offered through this system is the *Climatological Data* (CD) publication, available by state. Previously, on-line subscribers were able to access this publication back to October 1997. Now, through CDMP, all of the CD publications for the entire publication history (back to the 1890s) have been scanned and are available on-line. By early 2004, each of the remaining serial publications (*Hourly Precipitation Data*, *Storm Data*, *Monthly Climatic Data for the World*, *Local Climatological Data*) will be added to this system. This will provide one easy access point for all of NCDC's serial publications. The system URL is: <http://www7.ncdc.noaa.gov/SerialPublications/>.

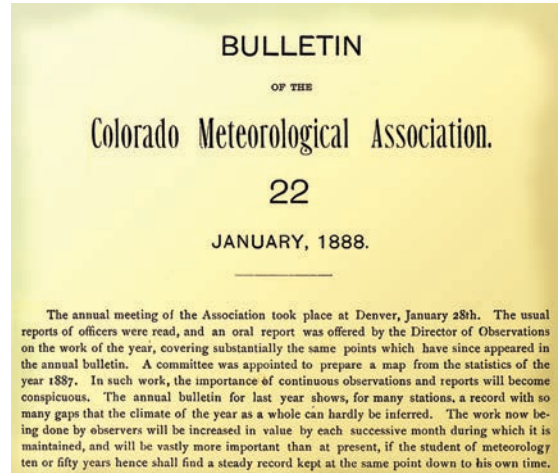
In December 2003, the CDMP held its Third Annual Data Access Workshop as a forum for information and experience exchange between the various NOAA task leaders. The workshop, held at the NOAA Coastal Services Center (CSC) in Charleston, South Carolina, allowed for the presentation of new and continuing proposals by NOAA line offices for the upcoming year's program.

Upper Air Data for Iraq

The Iraqi Upper Air Collection data from the late 1950s through the mid 1980s are on loan to CDMP through the Air Force Combat Climatology Center (AFCCC). These data were provided to AFCCC so they could be preserved before deteriorating beyond the point of readability. Approximately 22,500 records will be imaged through CDMP for the Air Force, which then plans to return the original records to the Iraqi Meteorological Service. The records are one-of-a-kind, and special precautions are being taken to guard their safety and ensure they are returned in the same or better condition than received. Once scanned, the data will be available on the Web Search Store Retrieve Display system (an on-line image database system) and will be accessible to researchers. The second phase of the project will be to key various upper air historical observations in the collection that are not already included in the historical Comprehensive Aerological Reference Data Set database.



Iraqi upper air records for Baghdad, total of 22,485 imaged records.



Climatological data publication for Colorado 1888.

U.S. Climate Reference Network (CRN)

Program Activity

At the end of 2003, a new, high-tech climate network of 37 stations designed by NOAA scientists to monitor the Nation's temperature and precipitation trends was judged to be ready for commissioning in January 2004. The CRN will improve the ability of America's decision-makers to form policies about programs impacted by climate variability and change. The CRN is expected to include more than 100 automated observing stations throughout the United States that monitor temperature, precipitation, solar and long wave radiation, and wind speed. The NOAA GOES satellite transmits the data received from these ground-based stations in near real-time to NCDC, where they are made available on-line to users around the world. NOAA continues to refine the network, through software and data calibration checks.



The CRN gives America a first-class observing network that will be in place for the next 50 to 100 years, and serve as a benchmark for monitoring the climate for evidence of long-term change. The network will help government and industry decision-makers shape policies that are affected by changes in America's climate. It also will provide future long-term observations of surface air temperature and precipitation that can be compared to past long-term observations, which will better detect present and future climate variability and change.

Each CRN station is located in a highly pristine environment to help eliminate human influences from confounding the interpretation of any observed changes in climate. Most of the 50 states, including nine large-scale climate regions, are represented in the network. The observing stations will be established at locations sensitive to climate change, and placed at or near stations having long-term historical climate records. At the end of 2003, there were 45 stations operating in 26 states, with additional deployments for the next two years planned at a rate of approximately 27 each year.



CRN Station: Fairbanks, Alaska

2003 Climate Contrasts Across the U.S.; Global Temperature Tied 2002 as Second Warmest on Record

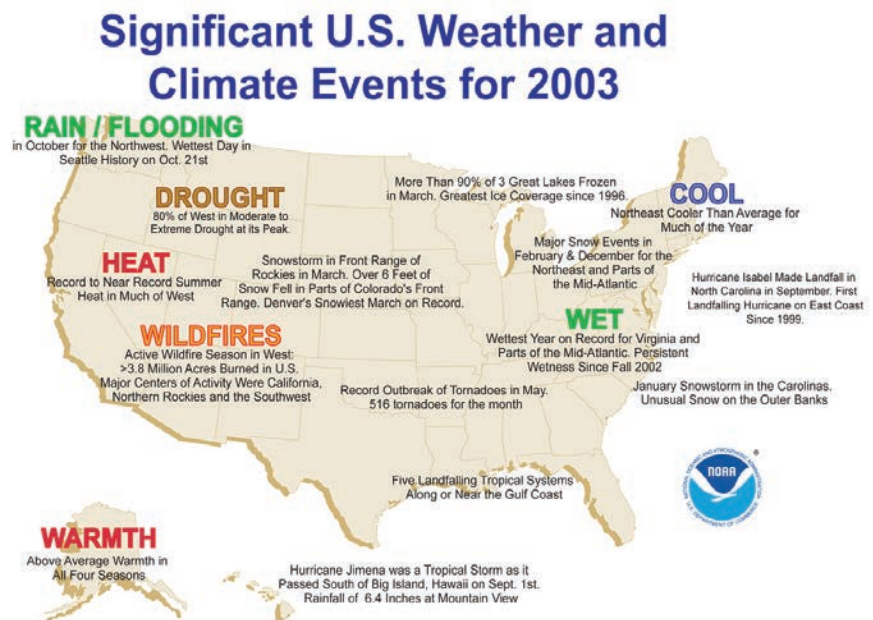
The climate of 2003 in the United States was wetter and cooler-than-average in the East, warmer and drier-than-average in the West, while drought conditions persisted, or worsened, throughout much of the central and western regions. The average temperature for the contiguous United States in 2003 was 53.7° F (12.1° C), the 20th warmest year since national records began in 1895. Temperatures in Alaska were above the 1971-2000 average in all four seasons.

The year also had sharp contrasts in precipitation across the country. While drier-than-average conditions persisted throughout much of the West, all states east of the Mississippi were significantly wetter than average (except Maine). Conversely, 17 states along and west of the Mississippi River were significantly drier than average. The combination of below-average precipitation and warmer-than-average temperatures contributed to persistent or worsening drought conditions. At year's end, moderate to extreme drought covered approximately 56 percent of 11 western states, a region where drought has persisted for the past three to five years in many locations.

The persistent lack of adequate rain and snowfall left reservoirs throughout much of the West below average at the end of 2003. However, even lower levels of western reservoirs were reported during periods of persistent drought in the 1950s and 1960s. Tree-ring records from the Upper Colorado River basin indicate that droughts like those of the 1950s and 1960s are not uncommon in that area, and droughts more persistent and intense than those in the instrumental record (20th, and 21st century) have occurred in the past 700 years.

Weather and climate stations, satellites, ships, buoys and floats indicate that the 2003 average global temperature ranked as second warmest on record, tied with 2002 but cooler than the record warm year of 1998. The 10 warmest years have all occurred since 1990. A moderate El Niño in the equatorial Pacific in January ended by April, and near neutral conditions persisted for the remainder of the year.

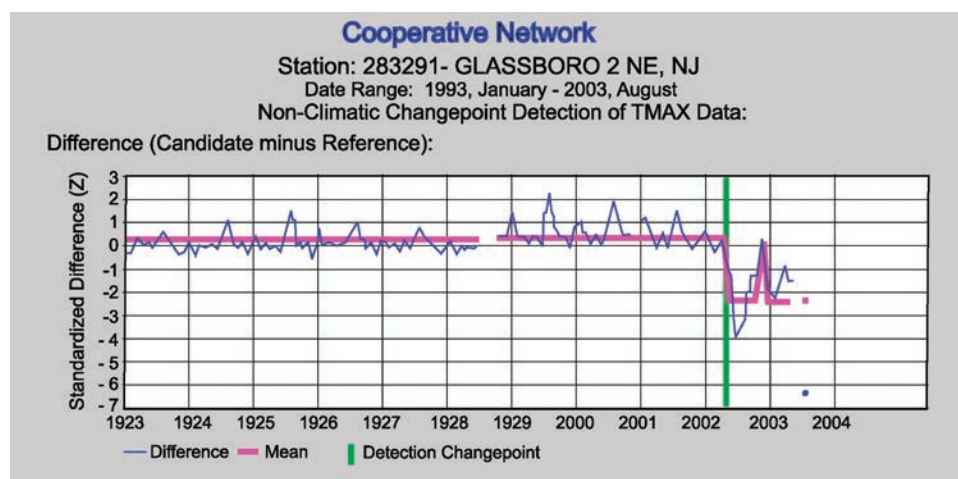
A record summer heat wave in Europe peaked in late July and August with the record high temperature in the United Kingdom observed on August 10, [100.6° F (38.1° C) at Gravesend-Broadness, Kent]. France had its warmest summer on record and temperatures soared across southern Asia in late May and June. Conversely, extremely cold winter temperatures occurred across Asia in January. Temperatures in northwestern Russia dropped to -50° F (-45° C), and thousands of deaths were attributed to extremely cold conditions in India and Bangladesh that month. Moscow received snowfall in June for the first time since 1963.



Health of the Network: Network Monitoring Web Page Launched

The Network Monitoring web page, established in July under the 'Climate Monitoring' link at <http://www.ncdc.noaa.gov>, provides summaries of a number of network performance measures relevant to the NWS Cooperative Observer Network (COOP). This is the first network assessed under the program known informally as the "Health of the Networks." Performance measure summaries are updated each new data month. Concise versions of the reports are sent to the NWS regional offices for ultimate dissemination to the COOP network field managers. The COOP performance measures include summaries of data receipt timeliness, completeness and an accounting of data quality and are used to identify potential changes or problems in the reporting practice of each COOP site.

A system to detect artificial change-points was added to the network monitoring capabilities in December 2003. This component was constructed to facilitate early warning of potential non-climatic changes to COOP temperature observations, especially undocumented changes (e.g., from instrument failures or undocumented equipment moves). The goal of early warning bias detection is to avoid prolonged contamination of the climate archive. All known observation practice changes (metadata) are provided graphically and in report form to distinguish documented from undocumented changes. Users of the system can access the network performance summaries in a variety of ways, including text reports, graphs and interactive GIS-based station maps. The GIS mapping options allow users to invoke station histories, report summaries and graphing options directly from the scalable map display. Additional networks will be added to the network monitoring system in 2004, including the newly commissioned CRN.

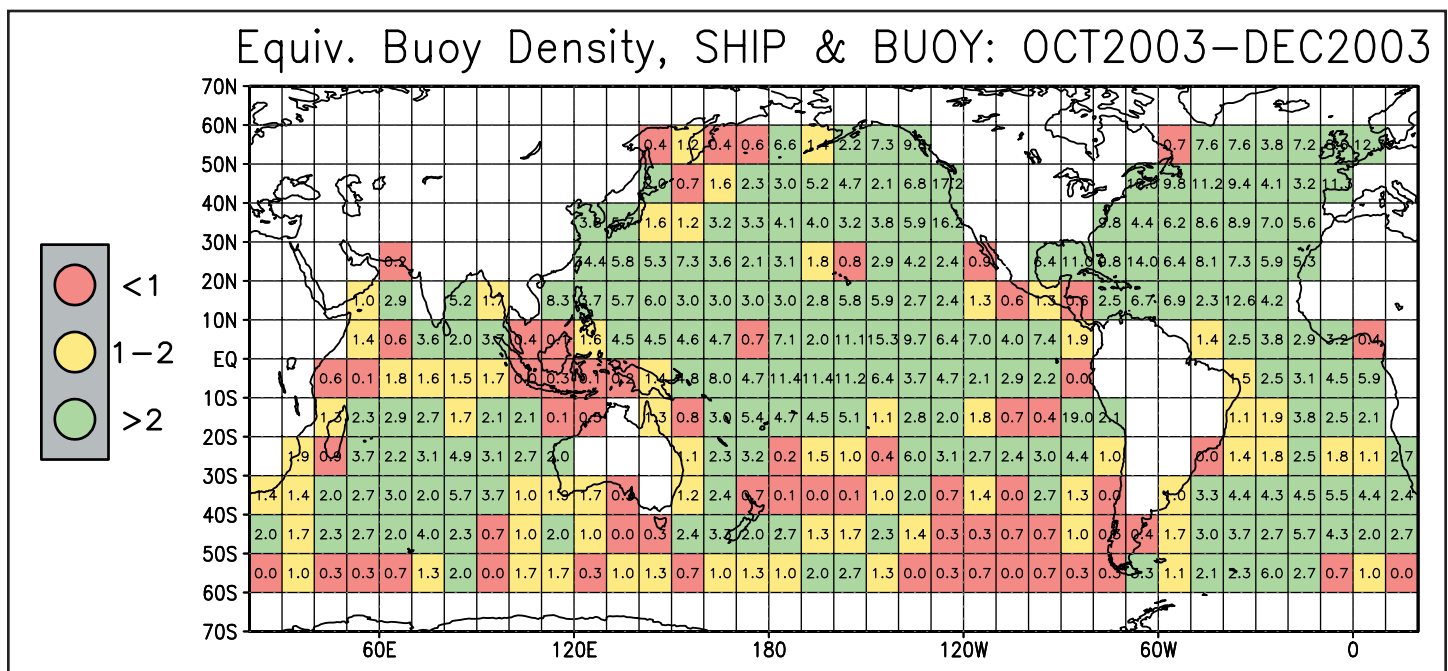


Sea Surface Temperatures (SST) Used to Define El Niño and La Niña

Analysis of past climate variations is an important part of understanding climate change, and an important indicator of climate is the surface temperature. An improved historic SST analysis has been produced from 1880 to present. This analysis is now being used by NWS's Climate Prediction Center to help define El Niño and La Niña events. The same analysis methods used for SST have been applied to the land surface temperatures from the Global Historical Climate Network and these two products have been merged to produce a spatially complete, combined surface temperature monthly analysis. The analysis includes a determination of errors and comparisons with other products.

Ocean Observations and Sea Surface Temperatures

Ocean observations have been collected for a variety of different purposes by various groups. Although these disparate observations provided important information about the ocean, an optimal observing system for climate was needed. The present in-situ (ship and buoy) and satellite observing system for SST was examined and an improved in-situ observing system for climate was recommended. The in-situ data have a critical role in the reduction of any satellite bias. Thus, the situ SST network was used to determine the minimum number of in-situ observations needed to correct any potential satellite bias to below 0.5°C . Simulations showed that bias errors could be reduced below 0.5°C if there were at least two buoys on a 10° grid.



Studies showed that seven ships were equivalent to one buoy and the buoy equivalent observations were determined by combining ships and buoys. As identified in the above figure, the three-month period, October-December 2003, identifies regions in red (critical) and yellow (important) where more buoys are needed. In total, 189 buoys are needed of which 102 are needed south of 20°S . NOAA's Atlantic Oceanographic and Meteorological Laboratory is now using these results to modify their buoy deployment plans.

NOAA Operational Model Archive and Distribution System (NOMADS)

The first ever U.S. National numerical weather prediction model archive became operational during 2003, providing on-line access to real-time and historical NCEP models and selected NCDC climate data. With more than 30,000 individual grids ingested daily, advanced data management techniques provide real-time access to individual model parameters across the entire period of record dating back to 2002. NOMADS provides access in multiple format neutral methods, such as:

Interactive Web Access

- A new on-line web access tool providing both traditional and distributed data access
- On-line access to individual model elements
- On-line analysis and display capabilities

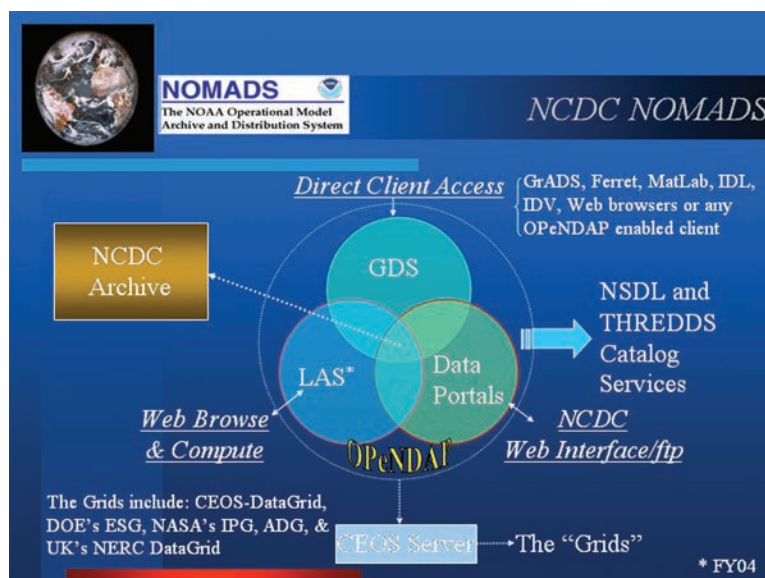
Multiple Access Methods

- All data are accessible using the OPeNDAP protocol for inter-operable access using desktop clients such as:
 - Gridded Analysis and Display Systems
 - Live Access Server
 - MatLab
 - Interactive Data Viewer
 - Interactive Data Language
 - Any “Distributed Oceanographic Data System” enabled client
 - Web-based http or ftp

Model Stewardship

- To ensure the highest quality and serially complete archive
- Two independent sources of ingest
- Real-time automated system and data monitoring performed hourly and daily
- QC checks, including real-time inspection of the data to data headers.

For access and information see: www.ncdc.noaa.gov/oa/model/model-resources.html.



Pre-1948 U.S. Daily Data On-line

A major milestone was completed in 2003 by providing web access to pre-1948 U.S. Daily Cooperative Station Data (DSI 3206). This extends the period of record back in time for numerous stations which previously had on-line data only back to 1948. Some of the sites now have on-line data back into the 1800s. The parameters include daily values of temperature, precipitation, and snow for thousands of stations across the United States. These data were keyed from forms, converted to the “standard” daily format through the CDMP, and have now been loaded into the Climate Data On-line (CDO) system to provide web access. The data can be accessed at: <http://cdo.ncdc.noaa.gov/>.

Integrated Surface Hourly (ISH) Database On-line

In 2003, NCDC continued its efforts in improving data quality and access to the ISH database, the most popular digital database requested by our customers. The entire 1900-2003 database (with additional QC applied) is now on-line for data file access via FTP. The 2003 portion of ISH is now on-line in the CDO system, where a web interface provides many data selection and output format options. In 2004, the CDO system will be operationally updated with the most recent data, and will also be populated with pre-2003 data until the full archive is available in the CDO. ISH contains surface weather observations recorded primarily at airports throughout the world, with more than 20,000 historical stations, and 10,000 currently active stations. The data can be accessed via: <http://cdo.ncdc.noaa.gov/>.

Freezing Rain and Ice Storm Data Set and CD-ROM

A new product entitled, “Long-Term Data Sets About Freezing Rain and Ice Storms in the U.S.,” was created in 2003 and placed on CD-ROM. This data set was developed with Stanley Changnon of Changnon Climatology as part of the Office of Global Programs funded project entitled, “Developing Data Sets for Assessing Long-Term Fluctuations in Freezing Rain and Ice Storms in the United States.” Data for NWS first-order stations cover the period 1930-2000, while data for the NWS cooperative observer stations cover the period 1940-2000. The product contains four data sets of freezing rain: 1) number of days per month with freezing rain recorded at first-order, and 2) cooperative stations, 3) number of hours per month with freezing rain recorded at first-order stations, and 4) ice storm loss data based on property insurance data.



Global Climate Observing System (GCOS)

During 2003, NCDC contributed in many ways to the GCOS endeavor and hosted a meeting of the GCOS Atmospheric Observation Panel for Climate. NCDC has maintained membership since the panel's inception in 1995. The GCOS Second Report on the Adequacy of the Global Observing System for Climate was published with an NCDC contributing author. As a WMO Commission for Basic System GCOS Lead Center, NCDC sought to improve the GCOS Surface and Upper Air Networks by: collecting additional data; making the data easily available to users; contacting countries to remind them of their obligations to provide GCOS data, preparing maps indicating data availability; and to encourage high quality observations creating a GCOS certificate suitable for hanging at a weather observing station to remind the observers of the importance of their data.

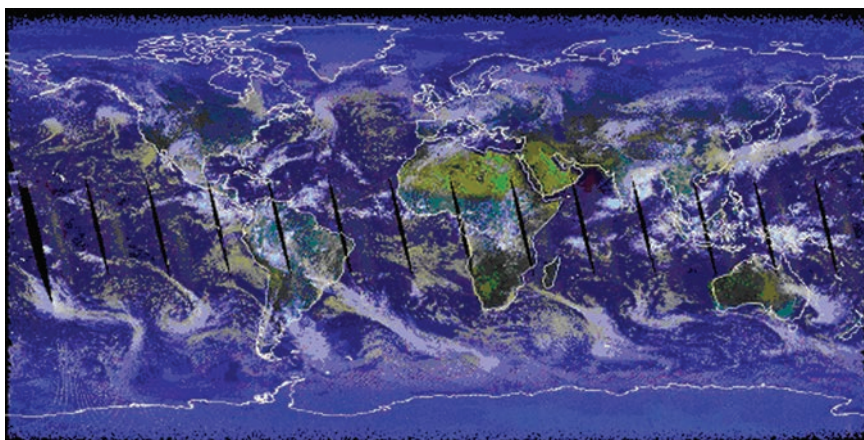


Cooperative Agreement for Climate and Weather Impacts on Society and the Environment (CWISE)

The Cooperative Agreement for CWISE was awarded to North Carolina State University (NCSU). This 4-year agreement will partner NCDC and NOAA's CSC, with NCSU, the University of South Carolina, and Clemson University. Through this agreement, NOAA will conduct research to better assess the continental impacts of climate variability and weather events on southeastern land and coastal interfaces that affect natural systems and society. CWISE will conduct research to support information and services that will be provided to mitigate against environmental, economic, ecosystem health and human health impacts related to extreme climate conditions and atmospheric storms.

International Satellite Cloud Climatology Project (ISCCP) Data Set

Since 1983, the NCDC has been the ISCCP central archive. Data received from the satellite processing centers consist of 3-hourly imagery from geostationary and polar-orbiter satellites at visible and infrared wavelengths. This is a global data set, because in addition to the data from GOES-East and West, NCDC receives data from the Japan Meteorological Agency (for Geostationary Meteorological Satellite data) and the European Organization for the Exploitation of Meteorological Satellites (for Meteosat data). The ISCCP global processing center also sends the results of the cloud statistics to the National Aeronautics and Space Administration's (NASA) Goddard Institute for Space Studies.



False color composite of ISCCP level B2 Polar Orbiter Data

NCDC also archives and processes ISCCP geostationary level B1 data and, for the polar satellite, level B2 data. During 2003, the processing of level B1 data, sent to NCDC from five international regional processing centers, was completely automated including ingest, archive, and status reporting. The level B2 polar processing was also fully automated. The B2 processing includes sub-sampling of the raw global area coverage Advanced Very High Resolution Radiometer data, collection of all calibration information, and writing these information to a standard format for later processing.

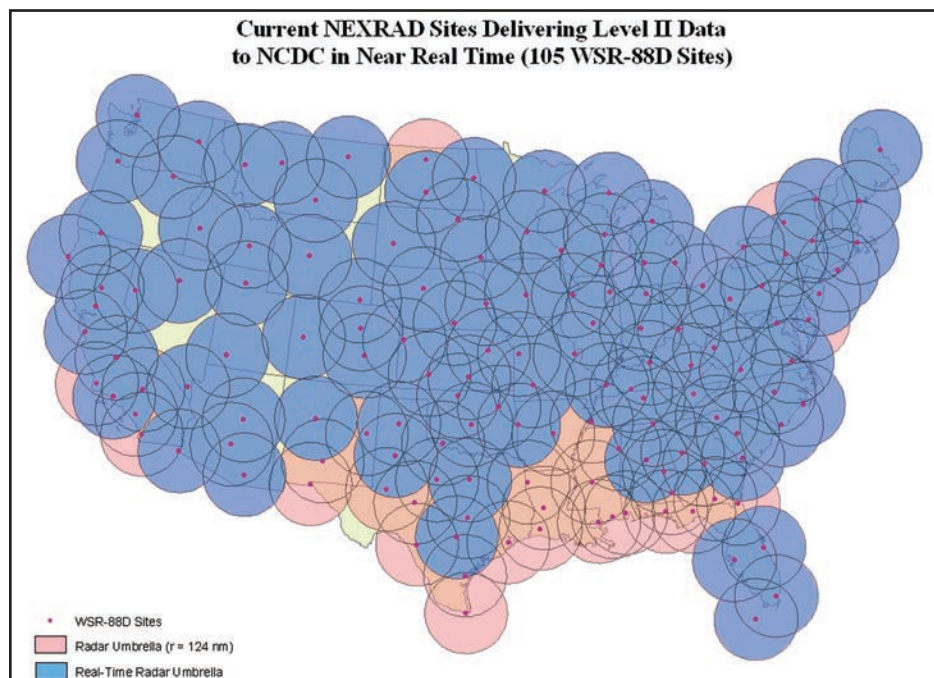
NOAA's Regional Climate Centers (RCC) and American Association of State Climatologists (AASC)

In 2003, NOAA's RCCs provided quality climate services to customers in all fifty states and Puerto Rico. RCC web sites were accessed over 50 million times in 2003, and over 10,000 off-line customer requests were filled, accounting for over \$250,000 in revenue. RCCs engaged in critical applied climate research programs in 2003: site selection for the CRN; development of climate indices for tracking West Nile Virus; and development of innovative quality assurance procedures for hourly temperature and precipitation data. A hallmark of collaboration between the RCCs and NCDC in 2003 centered on data rescue activities associated with NCDC's CDMP, which has culminated in the extension of available digital surface daily records from the late 19th Century to the middle of the 20th Century. NOAA's RCCs are poised to enhance their climate services capabilities in the immediate future with ongoing enhancements to their shared Applied Climate Information System, which is synchronized with data holdings at NCDC.

NCDC's productive partnership with the AASC continued in 2003. Individual State Climate Offices continued to enhance their web presence and data resources in collaboration with NCDC. AASC members assisted NCDC in numerous data rescue efforts, and worked closely with the RCCs to coordinate and exchange information on mesonets. With the support of NCDC, both RCCs and the AASC continued to cultivate partnerships with NOAA's NWS, Climate Services Division.

Next Generation Radar (NEXRAD) Real-time Data

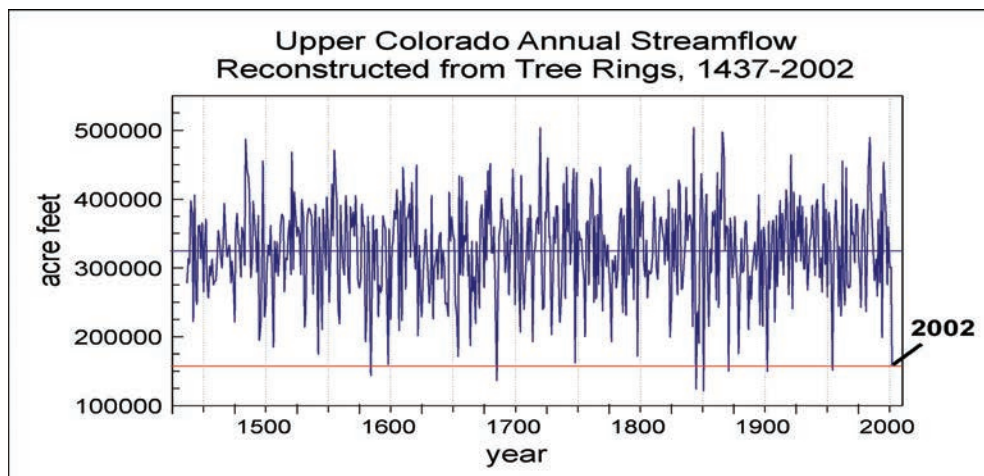
The year 2003 culminated a great collaboration of NCDC, the Radar Operations Center (Tri-agency NWS, Department of Defense, and Federal Aviation Administration), NWS National Severe Storms Laboratory, Oklahoma University, University Corporation for Atmospheric Research (UCAR) (University Data - UNIDATA), and the North Carolina Sea Grant. At the end of the year, 102 of the 156 NEXRAD sites were transmitting their data electronically in real-time,



greatly reducing the archive and access costs to NOAA and its customers. Among the benefits were: an increased data capture from 65% to greater than 95%; reduced time from observation to archive; and reduced time to customer availability from months to hours. Great strides were made in developing a browse and visualization capability, and the data and visualization capability were provided on-line free of charge. Real-time dynamic "data mining" tools are being developed to permit highly autonomous software to identify, select, and extract critical parameters for immediate analysis and use, which will lead to identification of specific weather events before they occur.

Drought Reconstructions

In 2003, a main concern of water resource managers in Colorado was whether a three-year drought, particularly severe in 2002, would continue into 2003. A set of tree-ring based reconstructions of annual streamflow for the Upper Colorado and South Platte River basin was developed and supplied to Front Range water resource managers who used them to guide planning. The reconstructed records provided a way to gauge the severity of 2002 year flow in a multi-century perspective, assess the frequency of such an event, and evaluate sequences of drought years over the past 300-600 years. Although drought conditions abated in 2003 for most areas of the state, a reconstruction of Upper Colorado River annual streamflow showed flow in 2002 to be closely matched to 1954. The only other year with lower flow in the 20th Century was 1902, which pre-dated most gage records. Even lower reconstructed flows occurred in previous centuries, most notably in the 19th Century, when two extreme low flow events occurred in the span of only seven years.



Collaboration with Academia

NOAA Paleoclimatology, a branch of NCDC's Scientific Services Division (ScSD), continues to build on its strong connections to the academic community. The Cooperative Institute for Research in Environmental Sciences at the University of Colorado is integral to the branch, managing data archives, developing materials, strategies and measures of evaluating the effectiveness for information transfer of paleoclimatic data and information. NOAA's Paleoclimatology Branch, which hosts the World Data Center for Paleoclimatology, also works closely with the University of Colorado to manage a global list serve of over 1,200 paleoclimatic researchers, with about half the subscribers being at academic institutions outside of the United States. These researchers are an important audience for the branch, being both users and contributors of the data archives. In addition, relationships with education and outreach experts at the Digital Library for Earth System Education and the UCAR assist in communicating and disseminating paleoclimatic science to education audiences around the world. Two staff have faculty appointments at the University of Colorado and maintain laboratories, supervise students, and conduct research along with colleagues at the Institute of Arctic and Alpine Research, and the departments of Geology and Geography. Research collaborations extend throughout the U.S. and abroad.

United Way Day of Caring

On the morning of September 11, 2003, NCDC volunteers assisted Erwin Middle School with special classroom projects, landscaping, and grounds work. They graded papers, hauled dirt, pulled weeds, organized an area in the library by rearranging books, spoke to the students about meteorology as a career, tutored students and worked one-on-one with students.

The volunteers, pictured at right, included: DeeDee Anders, Jan Carpenter, Deb Franklin, Helen Frederick, Kathy Hawkins, Stuart Hinson, Roz Ledford, Liz Love-Brotak, Elaine Mason, Karon Mathews, Tammy McLaughlin, Karen L. Miller, Bob Nagan, Karen Owen, Karol Pittman, Jenny Pressley, Ken Schmidt, Carmella Watkins, Vernell Woldu, and Vickie S. Wright.



This activity was organized by the Volunteer Center of Asheville and the United Way of Western North Carolina. It honors the memory of those slain during September 11, 2001, by giving back to the community. It also serves as the initial event for the Combined Federal Campaign which surpassed its goal in Asheville, North Carolina, by raising \$30,611.00.



Bring a Child to Work Day

Bring a Child to Work Day on April 24, 2003, gave 15 children (ages 7-18) an opportunity to see a scientific organization at work or to shadow an employee of the organization. This awareness helps to stimulate the young person's mind to consider a scientific field as a career and presentations included: interactive presentation on weather instruments; map discussion and presentation; Center tour; basic climate/weather mechanics and dynamics. Each child was given a bag of weather-related items, a pizza lunch, and a certificate of participation. NCDC participants, pictured at left, included: William Angel, Helen Frederick, Tom Ross, Peter Steurer, and Carmella Watkins.

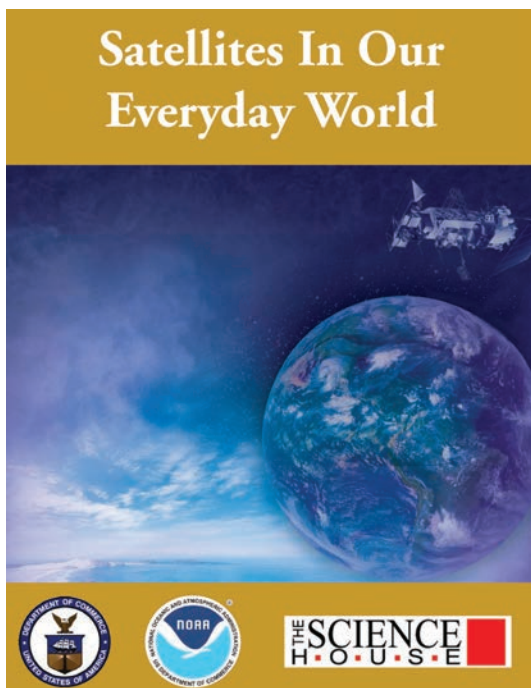
Groundhog Job Shadow Day

NCDC was a host for Groundhog Job Shadow Day on January 31, 2003. Three Asheville High School students who participated were highly motivated in computers. Special skills that were featured in the workplace included: telephone etiquette; word processing; spreadsheets; e-mail; graphics design; faxing capability; and meeting and presentation skills. A special Groundhog Day map discussion highlighted some little known weather facts about Groundhog Day weather. The students enjoyed lunch with the Center employees. The national sponsors of this event are America's Promise, Junior Achievement, School to Work Opportunities, and American Society of Association Executives.



NOAA's "Satellites in Our Everyday World" 2003 Conference

The "Satellites in Our Everyday World" Conference held March 13-16, 2003, in Raleigh, North Carolina, was very well received. For the first time, the conference was graciously co-hosted by the NCSU. The conference featured 13 speakers and approximately 50 registered participants who were mainly middle and high school teachers from the southeastern region of the United States. Some traveled from as far as Indiana to participate. The goal of the conference was to inform and involve teachers on how satellite data and communication technology can be easily incorporated into the classroom curriculum to make learning about satellites and what they do a fun learning experience. The conference included several "hands-on" applications and featured exercises where teachers were able to interpret real-time and historical satellite imagery and movie loops. Particular features could be identified by switching from one satellite band to another. A few of the more memorable presentations included a very simple exercise in building a miniature satellite with a working thermal detector to an entertaining presentation on satellite and meteorology using magic tricks. Another popular presentation was given by NASA Goddard Space Flight Center's Aqua Outreach Program teacher, Katherine Bender, who highlighted many of NASA's webcasts, which are live and interactive, focusing on the connection between Aqua science and engineering and high school Earth science curriculum.



Interactive Intro to Dendro Tree Ring Kit

To communicate how paleoclimatologists conduct research of past climate variability using natural recorders such as tree rings, the Paleoclimatology Branch of NCDC's ScSD developed a hands-on, interactive "Intro to Dendro Tree Ring Kit."

Dendroclimatologists and middle school teachers helped put together an assortment of materials and resources designed to allow students to conduct their own paleoclimatic analysis. Armed with cross sections from a Ponderosa Pine and blown-up images of cores taken from Douglas-fir trees near Boulder, Colorado, students can: examine the different widths in tree rings; learn that trees are sensitive to precipitation; compare the rings with monthly records and annual summaries of precipitation from the region; learn how tree ring records are calibrated with the instrumental record; and are challenged to explain why in some wet years the rings are no wider than in a dry year. The Tree Ring activity was popular among middle school students at the NOAA Science Day. A web-based version of the Tree Ring activity is in development.



Cores from two Douglas-fir trees growing in Eldorado Canyon

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Note: Those personnel indicated with an "*" either retired, resigned, or transferred during the 2003 calendar year.

Air Force Combat Climatology Center.....	AFCCC
American Association of State Climatologists	AASC
Automated Surface Observation System	ASOS
Climate Database Modernization Program	CDMP
Climate Data On-line	CDO
Climate Data Records	CDR
Climate Reference Network.....	CRN
Climate and Weather Impacts on Society and the Environment.....	CWISE
Climatological Data	CD
Coastal Services Center	CSC
Comprehensive Large Array-data Stewardship System	CLASS
Cooperative Observer Program.....	COOP
Geographical Information System	GIS
Geostationary Operational Environmental Satellite	GOES
Global Climate Observing System.....	GCOS
Integrated Surface Hourly.....	ISH
International Satellite Cloud Climatology Project.....	ISCCP
National Aeronautics and Space Administration	NASA
National Center for Environmental Prediction	NCEP
National Climatic Data Center.....	NCDC
National Environmental Satellite, Data, and Information Service	NESDIS
National Oceanic and Atmospheric Administration	NOAA
National Weather Service.....	NWS
Next Generation Radar	NEXRAD
NOAA Operational Model Archive and Distribution System	NOMADS
North Carolina State University.....	NCSU
Precipitation Validation.....	PrecipVal
Quality Control	QC
Regional Climate Center.....	RCC
Remote Sensing and Applications Division.....	RSAD
Scientific Data Stewardship	SDS
Scientific Services Division	ScSD
Sea Surface Temperature	SST
University Corporation for Atmospheric Research.....	UCAR
University Data	UNIDATA
Weather Surveillance Radar-1988 Doppler	WSR-88D
World Meteorological Organization	WMO

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Deborah Riddle	layout, graphics support and design
Sara Veasey	graphics support and design
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Linda Preston	references
Jeff Lukas	
Institute of Arctic and Alpine Research	
University of Colorado	tree core photo (page 18)

New NCDC Web Page Launched

The new NCDC web site was a direct result of the NCDC 2002 Management Retreat. A retreat goal was set to improve user accessibility to data and products at NCDC via the web, and to allow quicker access for both scientists and novices, and all those in between. A Web Design Team was formed from all functional areas of NCDC, bringing together a diverse group of people with a common goal. The new web page is now on-line, and the Web Design Team is tackling underlying pages to ensure visitors to the NCDC web site have a positive experience. Web Design Team members included: David Anderson, Jan Carpenter, Steve Fleming, Deborah Franklin, Axel Graumann, Neal Lott, Liz Love-Brotak, Tammy McLaughlin, Tim Owen, Jenny Pressley, Ken Schmidt, David Smith, and Sara Veasey.

NOAA Satellites and Information
National Environmental Satellite, Data, and Information Service

National Climatic Data Center

DOC > NOAA > NESDIS > NCDC

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National Climatic Data Center
Protecting the Past, Revealing the Future

Land Based

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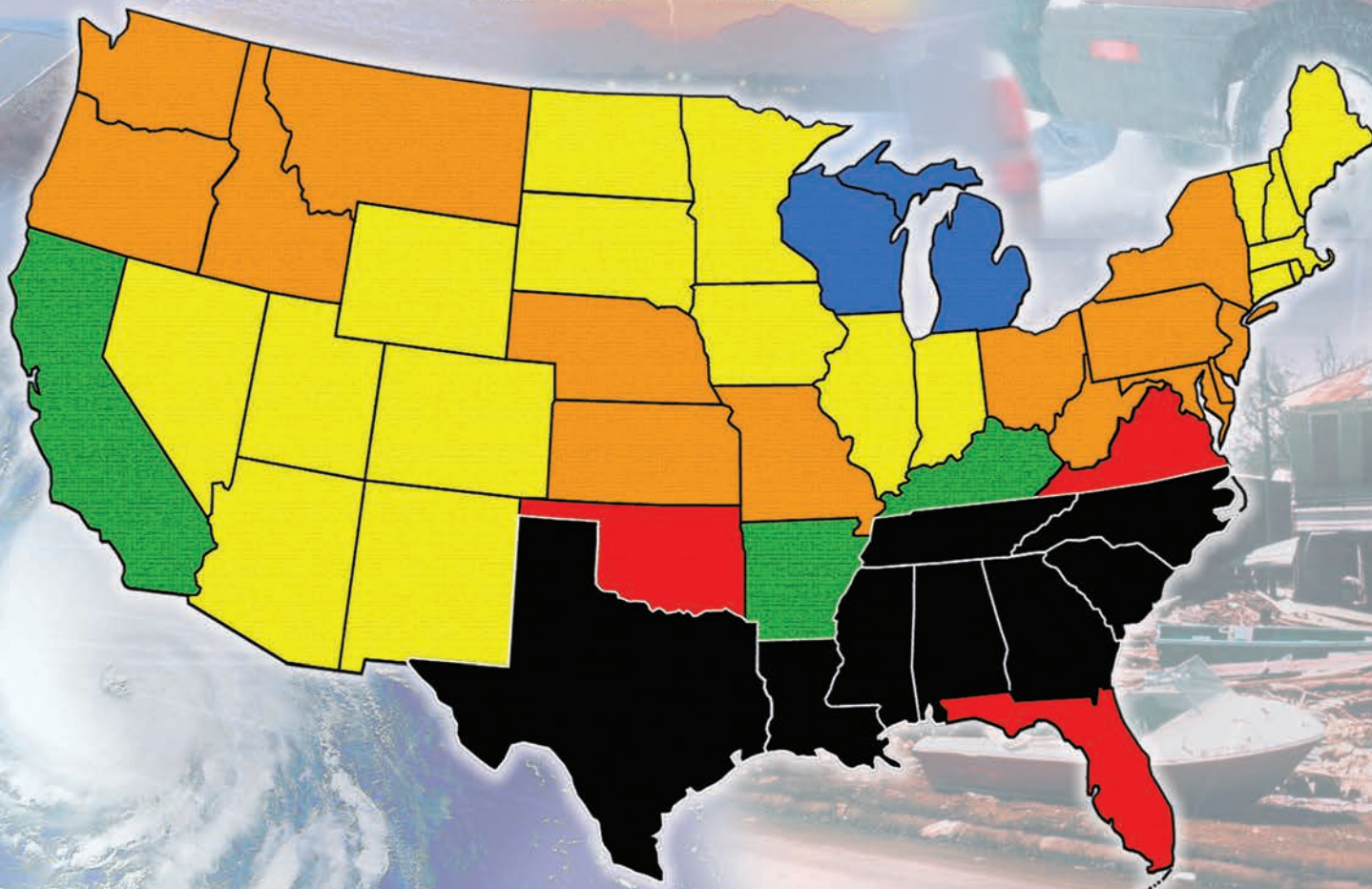
Marine





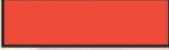

Weather/Climate Events, Information, & Assessments



BILLION DOLLAR CLIMATE AND WEATHER DISASTERS

1980 - 2003



NUMBER OF EVENTS		DISASTER TYPE	NUMBER OF EVENTS	PERCENT FREQUENCY	NORMALIZED DAMAGES (Billions of Dollars)	PERCENT DAMAGE
	1 - 3	Tropical Storms/Hurricanes	16	28.0%	102	29.2%
	4 - 6	Non-Tropical Floods	12	21.0%	55	15.8%
	7 - 9	Heatwaves/Droughts	10	17.0%	144	41.2%
	10 - 12	Severe Weather	7	12.0%	13	3.7%
	13 - 15	Fires	6	10.0%	13	3.7%
	16 - 20	Freezes	2	3.5%	6	1.7%
		Blizzards	2	3.5%	9	2.6%
		Ice Storms	2	3.5%	5	1.4%
		Noreaster	1	1.5%	2	0.7%
			58		349	

The NCDC Vision and Mission:



To be the most comprehensive and accessible source of quality climate and weather related data and information services and to be an objective authority on climate monitoring;

To provide stewardship and access to the Nation's resource of global climate and weather related data and information, and assess and monitor climate variation and change.

These efforts require the acquisition, quality control, processing, summarization, dissemination, and preservation of a vast array of climatological data generated by national and international meteorological services.



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